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Standard Guide for Prioritization of Data Needs for Pavement Management[1]

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1. Scope

1.1 This guide identifies data needs for pavement management systems. It also addresses the relative importance of various types of pavement data.

1.2 This guide was developed for use by federal, state, and local agencies, as well as consultants who provide services to those agencies.

1.3 This guide describes a process and provides a set of recommendations that any agency may use to develop a plan for acquiring pavement management data. Any individual agency may justifiably assign higher or lower priority to specified data items depending on their needs and policy.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D3319 Practice for the Accelerated Polishing of Aggregates Using the British Wheel

D4123 Test Method for Indirect Tension Test for Resilient Modulus of Bituminous Mixtures (Withdrawn 2003)[3]

D4602 Guide for Nondestructive Testing of Pavements Using Cyclic-Loading Dynamic Deflection Equipment

D4694 Test Method for Deflections with a Falling-Weight-Type Impulse Load Device

D4695 Guide for General Pavement Deflection Measurements

D4748 Test Method for Determining the Thickness of Bound Pavement Layers Using Short-Pulse Radar

D5340 Test Method for Airport Pavement Condition Index Surveys

D6433 Practice for Roads and Parking Lots Pavement Condition Index Surveys

E274 Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire

E303 Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester

E445/E445M Test Method for Stopping Distance on Paved Surfaces Using a Passenger Vehicle Equipped With Full-Scale Tires

E501 Specification for Rib Tire for Pavement Skid-Resistance Tests

E503/E503M Test Methods for Measurement of Skid Resistance on Paved Surfaces Using a Passenger Vehicle Diagonal Braking Technique (Withdrawn 2010)[3]

E524 Specification for Smooth Tire for Pavement Skid-Resistance Tests

E556 Test Method for Calibrating a Wheel Force or Torque Transducer Using a Calibration Platform (User Level)

E660 Practice for Accelerated Polishing of Aggregates or Pavement Surfaces Using a Small-Wheel, Circular Track Polishing Machine (Withdrawn 2006)[3]

E670 Test Method for Testing Side Force Friction on Paved Surfaces Using the Mu-Meter

E770 Test Method for Classifying Pavement Surface Textures (Withdrawn 1991)[3]

E867 Terminology Relating to Vehicle-Pavement Systems

E950 Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

E965 Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique

E1082 Test Method for Measurement of Vehicular Response to Traveled Surface Roughness

E1166 Guide for Network Level Pavement Management

E1170 Practices for Simulating Vehicular Response to Longitudinal Profiles of Traveled Surfaces

E1215 Specification for Trailers Used for Measuring Vehicular Response to Road Roughness

[1] This guide is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.42 on Pavement Management and Data Needs.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

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E1274 Test Method for Measuring Pavement Roughness Using a Profilograph
E1337 Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using Standard Reference Test Tire
E1911 Test Method for Measuring Paved Surface Frictional Properties Using the Dynamic Friction Tester
E1926 Practice for Computing International Roughness Index of Roads from Longitudinal Profile Measurements

2.2 *Other Publications:*

Guidelines on Pavement Management, AASHTO (1990)[4]
AASHTO Guide for Design of Pavement Structures, AASHTO (1986)[4]
FHWA Pavement Policy for Highways, Federal Register, Vol 54, No. 8 pp. 1353–58 (Jan. 13, 1989)[5]
Pavement Management Practices, NCHRP Synthesis 135 (1987)[6]
Guidelines and Procedures for Maintenance of Airport Pavements, FAA Circular 150-5320-6[7]
Distress Identification Manual, FHWA, Publication No. FHWA-RD-03-031 June 2003[8]

3. Significance and Use

3.1 A key objective of all pavement-management systems (PMS) is to provide a factual basis for improving the quality of decision making regarding the budgeting, design, programming, construction, maintenance and operation of a pavement network. Quality decision making requires a current inventory of the pavement system, evaluation of the present condition and use of the pavement system, estimation of future condition, and the implications of any changes in condition.

3.2 This guide may be used to identify data needs for pavement management by considering the use, generic type, and relative importance of the pavement. It can also assist in identifying methods for obtaining the data.

3.3 Any data element selected for collection should have a specific use and be of value in providing information from the PMS for the decision making process.

3.4 The specific type of data needed to make informed pavement management decisions will vary with such factors as the size, complexity and condition of the pavement network, the levels of service to be provided, the agency budget and budgeting process. Further, since pavement management is a dynamic process, responsive to changes in technology, the data needs for a particular agency may be expected to change over time. Accordingly, judgment invariably will be required in applying this guide to develop a hierarchy of data needs.

4. Data Types and Acquisition Methods

4.1 General types of pavement management data include the actual physical measurement of the pavement, information about usage, (that is, traffic and accident data) and administrative information. Both the types and acquisition methods of pavement management data can be generally classified.

4.2 The most appropriate classifications for the various types of pavement data are those related to the following groups.

4.2.1 *Performance,* the ability of a pavement to fulfill its purpose over time as reflected in the measurable change in condition over time,

4.2.2 *History,* past occurrences that influence pavement performance,

4.2.3 *Costs,* investment necessary for performance improvement or the liability as a result of declining performance,

4.2.4 *Policies and Regulations,* decisions that are made as constraints to pavement systems,

4.2.5 *Geometry,* alignment, dimensions and shape of the pavement and its appurtenances, and

4.2.6 *Environment,* external factors affecting pavement performance.

4.3 This classification scheme has been used to incorporate all the component generic data types in Table 1. Table 1 also presents the corresponding methods to acquire those data types, again on a generic basis.

5. Sample Size and Frequency

5.1 The collection of pavement management data may be continuous or may involve a sampling process based on time, location, or other suitable parameters. The general type of sample (stratified or continuous), its size, and the time interval between repeat sampling, may vary considerably from agency to agency and from one type of analysis to another. The appropriate type and rate of sampling is dictated primarily by the nature of the analysis to be performed (that is, network versus project, trend analysis versus project design), the relative importance of the end use (that is, policy setting versus routine analysis), the budget of the managing agency, as well as conventional statistical considerations required to ensure that the data will be sufficiently accurate and precise to permit valid interferences to be drawn.

6. Typical Uses of Pavement Management Data

6.1 Pavement management data is used for network and project level purposes. Network level management requires information for planning, budgeting, and forecasting trends. Project level management requires information for design and engineering of specific pavement sections or projects. The various data are used in network and project level analysis as shown in Table 2.

7. Factors in Establishing Priorities

7.1 The following factors are important and should be considered in establishing data priorities, although not necessarily in the order listed.

7.1.1 *Type and class of facility,* highway (urban versus rural); airfield (commercial versus general);

[4] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

[5] Available from the U.S. Department of Transportation, Federal Highway Administration, Washington, DC 20590, http://www.dot.gov/new.

[6] Available from the Transportation Research Board, The National Academies, 500 Fifth Street, NW Washington, DC 20001, http://www.trb.org.

[7] Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, http://www.faa.gov.

[8] Available from the Federal Highway Research, 6300 Georgetown Pike, McLean, Virginia, 22101

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TABLE 1 Pavement Management Data Items and Acquisition Methods

Data Category	Typical Acquisition Method(s)	Available Related ASTM Standards
	Performance-Related	
Roughness	subjective rating	
	response type equipment	E1082, E1215
	profile measurement and response simulation	E950, E1170
	profilograph measurements	E1274
Surface distress	pavement distress surveys (manual or automated)	D5340, D6433
Friction	side force equipment	E670
	locked wheel equipment	E274, E445/E445M, E501, E503/E503M, E524, E556
	dynamic friction tester	E1911
	peak braking coefficient equipment	E1337
	pendulum equipment	E303
	texture measurement methods	D3319, E660, E770, E965
Deflection	impulse equipment	D4694, D4695
	static equipment	D4695
	cyclic force equipment	D4602,D4695
Layer material properties	in-situ and laboratory material testing	Many ASTM standards (Vol 04.03)
	back-calculation of material properties from field tests	None exist. Several useful methods available
	nondestructive pavement tests	D4694, D4695
	layer thickness	D4748
	History-Related	
Maintenance history	records, estimates, surveys, in-situ testing	
Construction history (includes new construction, reconstruction, rehabilitation and repair)	as-built records, estimates, surveys, in-situ testing	
Traffic	records, estimates and surveys	
Accidents	records, estimates and surveys	
	Cost-Related	
Construction costs (includes new construction, reconstruction, rehabilitation and repair)	records, estimates and surveys	
Maintenance costs	records, estimates and surveys	
User costs	records, estimates and surveys	
	Policy-Related	
Budget	records, public officials and other agencies	
Available alternatives	records, organizations, suppliers and other agencies	
Levels of service	public officials and policy statements	
	Geometry-Related	
Section dimensions	records, estimates, direct measure and in-situ testing	
Curvature	records, estimates and direct measure	
Cross slope	records, estimates and direct measure	
Vertical curvature	records, estimates and direct measure	
Shoulder/curbs	records, estimates and direct measure	
	Environment-Related	
Drainage	analysis from records or field observation/measurement	
Climate	analysis from records or field observation/measurement	

7.1.2 *Functional classification,* highway (freeway, arterial, collector, local); airfield (runway, taxiway, apron),

7.1.3 *Levels-of-service,* that is, limiting values of roughness, severity and extent of various types of surface distress, etc.,

7.1.4 *Size of pavement network,*

7.1.5 *Type of agency,* that is, federal, state, local,

7.1.6 *Characteristics of agency,* that is, size, technical expertise, budget, data acquisition and data processing capabilities, policy, etc.,

7.1.7 *Traffic,* for highways: traffic volumes, vehicle classes and weights; for airfields: maximum wheel loads, number of repetitions of various loads,

7.1.8 *Intended use(s) and users of data,* that is, develop status reports, planning and programming documents, design or maintenance requirements, assess current analysis techniques, develop legislation and public information,

7.1.9 *Type and cost of data acquisition,* that is, manual, semi-automated, automated,

7.1.10 *Required precision and bias of various elements,* apply general policy or standards,

7.1.11 *Prevalent distress types,* rutting, raveling, cracking, etc.

7.1.12 *Frequency of data collection,* that is, time and space may vary with type of facility, agency budget, current network condition, etc., and

7.1.13 *Requirements for output to other agencies,* for example, legislative/administrative mandates.

8. Priority of Data Needs Guidelines

8.1 Many of the factors listed in Section 7, and described in more detail in Table 2, have been considered in developing guidelines that indicate the relative importance of the various data items in network and project level applications. These guidelines are shown in Table 3, Table 4, and Table 5 respectively, for roads, airfields, and other paved areas.

8.2 In the tables, the relative importance of a data to the item to the decision made at a given level is classified as either high, medium, or low (H, M, or L).

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